

CLAIMS:

1. A method for preparing a rubber modified thermoplastic resin comprising a discontinuous elastomeric phase dispersed in a rigid thermoplastic phase, wherein at least a portion of the rigid thermoplastic phase is grafted to the elastomeric phase, which comprises the steps of:
 - (a) polymerizing a mixture of monomers in a first stage in the presence of the elastomeric phase, at least one of which monomers is selected from the group consisting of vinyl aromatic monomers and at least one of which monomers is selected from the group consisting of monoethylenically unsaturated nitrile monomers, followed by
 - (b) polymerizing one or more monomers in at least one subsequent stage in the presence of the elastomeric phase from (a), wherein the one or more monomers comprise at least one monomer selected from the group consisting of (C₁-C₁₂)alkyl- and aryl-(meth)acrylate monomers.
2. The method of claim 1, wherein the elastomeric phase comprises a polymer having structural units derived from at least one (C₁-C₁₂)alkyl(meth)acrylate monomer.
3. The method of claim 2, wherein the alkyl(meth)acrylate monomer is butyl acrylate.
4. The method of claim 2, wherein the polymer of the elastomeric phase further comprises structural units derived from at least one polyethylenically unsaturated monomer.
5. The method of claim 4, wherein the polyethylenically unsaturated monomer is selected from the group consisting of butylene diacrylate, divinyl benzene, butene diol dimethacrylate, trimethylolpropane tri(meth)acrylate, allyl methacrylate, diallyl methacrylate, diallyl maleate, diallyl fumarate, diallyl phthalate, triallyl methacrylate, triallylisocyanurate, triallylcyanurate, the acrylate of tricyclodecenylalcohol and mixtures thereof.

6. The method of claim 1, wherein the elastomeric phase comprises about 10 to about 80 percent by weight of the rubber modified thermoplastic resin.
7. The method of claim 1, wherein the elastomeric phase comprises about 35 to about 80 percent by weight of the rubber modified thermoplastic resin.
8. The method of claim 1, wherein the elastomeric phase initially comprises particles selected from the group consisting of a mixture of particles sizes with at least two mean particle size distributions and a broad size distribution having particles ranging in size from about 50nm to about 1000nm.
9. The method of claim 8, wherein the at least two mean particle size distributions are each in a range of between about 80nm and about 500nm.
10. The method of claim 1, wherein at least about 5 weight % to about 90 weight % of rigid thermoplastic phase is chemically grafted to the elastomeric phase, based on the total amount of rigid thermoplastic phase in the composition.
11. The method of claim 1, wherein the mixture of monomers in the first stage comprises styrene and acrylonitrile, or alpha-methyl styrene and acrylonitrile or a mixture of styrene, alpha-methyl styrene and acrylonitrile.
12. The method of claim 11, wherein the wt./wt. ratio of styrene, alpha-methyl styrene or mixture thereof to acrylonitrile is in a range of between about 1.5:1 and about 4:1.
13. The method of claim 11, wherein the wt./wt. ratio of styrene, alpha-methyl styrene or mixture thereof to acrylonitrile is in a range of between about 2:1 and about 3:1.
14. The method of claim 11, wherein the wt./wt. ratio of styrene, alpha-methyl styrene or mixture thereof to acrylonitrile is about 2.6:1.
15. The method of claim 1, wherein the mixture of monomers in the first stage is employed in an amount in a range of between about 5 wt.% and about 98 wt.% based on the total weight of monomer employed in all stages.

16. The method of claim 1, wherein the mixture of monomers in the first stage is employed in an amount in a range of between about 15 wt.% and about 85 wt.% based on the total weight of monomer employed in all stages.
17. The method of claim 1, wherein in step (b) the monomer comprises methyl methacrylate.
18. The method of claim 17, wherein the monomer is a mixture further comprising at least one vinyl aromatic monomer.
19. The method of claim 17, wherein the monomer is a mixture further comprising at least one vinyl aromatic monomer and at least one monoethylenically unsaturated nitrile monomer.
20. The method of claim 19, wherein the wt./wt. ratio of methyl methacrylate to the total of vinyl aromatic monomer and monoethylenically unsaturated nitrile monomer is in a range of between about 3:1 and about 1:3.
21. The method of claim 17, wherein the monomer is a mixture further comprising styrene and acrylonitrile.
22. The method of claim 1, further comprising the step of combining the rubber modified thermoplastic resin with rigid thermoplastic phase prepared in a separate polymerization step.
23. The method of claim 22, wherein the rigid thermoplastic resin is a styrene-acrylonitrile copolymer.
24. The method of claim 22, wherein the rigid thermoplastic resin is a styrene-acrylonitrile-methyl methacrylate copolymer.
25. The method of claim 22, wherein the rigid thermoplastic resin separately prepared is combined at a level of between about 30 wt. % and about 80 wt. % based on the weight of the entire composition.

26. The method of claim 1, wherein the rubber modified thermoplastic resin further comprises an additive selected from the group consisting of colorants, dyes, pigments, lubricants, stabilizers, fillers and mixtures thereof.
27. A method for preparing a rubber modified thermoplastic resin comprising about 35 to about 70 wt.% based on the total weight of the resin of an elastomeric phase comprising structural units derived from butyl acrylate, wherein the elastomeric phase is dispersed in a rigid thermoplastic phase, and wherein at least a portion of the rigid thermoplastic phase is grafted to the elastomeric phase, which comprises the steps of:
 - (a) polymerizing in a first stage in the presence of the elastomeric phase a monomer mixture of styrene and acrylonitrile in a wt./wt. ratio of about 2.6:1, wherein the amount of monomer mixture employed is in a range of between about 15 wt.% and about 85 wt.% based on the total weight of monomer employed in all stages, followed by
 - (b) polymerizing in a second stage in the presence of the elastomeric phase from (a), a mixture of styrene, acrylonitrile and methyl methacrylate, wherein styrene and acrylonitrile are employed in a wt./wt. ratio in a range of between about 1.5:1 and about 4:1, and the wt./wt. ratio of methyl methacrylate to the total of styrene and acrylonitrile is in a range of between about 3:1 and about 1:3.
28. The method of claim 27, further comprising the step of combining the rubber modified thermoplastic resin with rigid thermoplastic phase prepared in a separate polymerization step.
29. The method of claim 28, wherein the rigid thermoplastic resin is a styrene-acrylonitrile copolymer.
30. The method of claim 28, wherein the rigid thermoplastic resin is a styrene-acrylonitrile-methyl methacrylate copolymer.

31. The method of claim 28, wherein the rigid thermoplastic resin separately prepared is combined at a level of between about 30 wt. % and about 80 wt. % based on the weight of the entire composition.
32. The method of claim 27, wherein the rubber modified thermoplastic resin further comprises an additive selected from the group consisting of colorants, dyes, pigments, lubricants, stabilizers, fillers and mixtures thereof.
33. A rubber modified thermoplastic resin composition comprising a discontinuous elastomeric phase dispersed in a rigid thermoplastic phase, wherein at least a portion of the rigid thermoplastic phase is grafted to the elastomeric phase, which is prepared by a method comprising the steps of:
 - (a) polymerizing a mixture of monomers in a first stage in the presence of the elastomeric phase, at least one of which monomers is selected from the group consisting of vinyl aromatic monomers and at least one of which monomers is selected from the group consisting of monoethylenically unsaturated nitrile monomers, followed by
 - (b) polymerizing one or more monomers in at least one subsequent stage in the presence of the elastomeric phase from (a), wherein the one or more monomers comprise at least one monomer selected from the group consisting of (C₁-C₁₂)alkyl- and aryl-(meth)acrylate monomers.
34. The composition of claim 33, wherein the elastomeric phase comprises a polymer having structural units derived from at least one (C₁-C₁₂)alkyl(meth)acrylate monomer.
35. The composition of claim 34, wherein the alkyl(meth)acrylate monomer is butyl acrylate.
36. The composition of claim 34, wherein the polymer of the elastomeric phase further comprises structural units derived from at least one polyethylenically unsaturated monomer.

37. The composition of claim 36, wherein the polyethylenically unsaturated monomer is selected from the group consisting of butylene diacrylate, divinyl benzene, butene diol dimethacrylate, trimethylolpropane tri(meth)acrylate, allyl methacrylate, diallyl methacrylate, diallyl maleate, diallyl fumarate, diallyl phthalate, triallyl methacrylate, triallylisocyanurate, triallylcyanurate, the acrylate of tricyclodecenylalcohol and mixtures thereof.
38. The composition of claim 33, wherein the elastomeric phase comprises about 10 to about 80 percent by weight of the rubber modified thermoplastic resin.
39. The composition of claim 33, wherein the elastomeric phase comprises about 35 to about 80 percent by weight of the rubber modified thermoplastic resin.
40. The composition of claim 33, wherein the elastomeric phase initially comprises particles selected from the group consisting of a mixture of particles sizes with at least two mean particle size distributions and a broad size distribution having particles ranging in size from about 50nm to about 1000nm.
41. The composition of claim 40, wherein the at least two mean particle size distributions are each in a range of between about 80nm and about 500nm.
42. The composition of claim 33, wherein at least about 5 weight % to about 90 weight % of rigid thermoplastic phase is chemically grafted to the elastomeric phase, based on the total amount of rigid thermoplastic phase in the composition.
43. The composition of claim 33, wherein the mixture of monomers in the first stage comprises styrene and acrylonitrile, or alpha-methyl styrene and acrylonitrile or a mixture of styrene, alpha-methyl styrene and acrylonitrile.
44. The composition of claim 43, wherein the wt./wt. ratio of styrene, alpha-methyl styrene or mixture thereof to acrylonitrile is in a range of between about 1.5:1 and about 4:1.

45. The composition of claim 43, wherein the wt./wt. ratio of styrene, alpha-methyl styrene or mixture thereof to acrylonitrile is in a range of between about 2:1 and about 3:1.
46. The composition of claim 43, wherein the wt./wt. ratio of styrene, alpha-methyl styrene or mixture thereof to acrylonitrile is about 2.6:1.
47. The composition of claim 33, wherein the mixture of monomers in the first stage is employed in an amount in a range of between about 5 wt.% and about 98 wt.% based on the total weight of monomer employed in all stages.
48. The composition of claim 33, wherein the mixture of monomers in the first stage is employed in an amount in a range of between about 15 wt.% and about 85 wt.% based on the total weight of monomer employed in all stages.
49. The composition of claim 33, wherein in step (b) the monomer comprises methyl methacrylate.
50. The composition of claim 49, wherein the monomer is a mixture further comprising at least one vinyl aromatic monomer.
51. The composition of claim 49, wherein the monomer is a mixture further comprising at least one vinyl aromatic monomer and at least one monoethylenically unsaturated nitrile monomer.
52. The composition of claim 51, wherein the wt./wt. ratio of methyl methacrylate to the total of vinyl aromatic monomer and monoethylenically unsaturated nitrile monomer is in a range of between about 3:1 and about 1:3.
53. The composition of claim 49, wherein the monomer is a mixture further comprising styrene and acrylonitrile.
54. The composition of claim 33, further comprising rigid thermoplastic phase prepared in a separate polymerization step.

55. The composition of claim 54, wherein the rigid thermoplastic resin is a styrene-acrylonitrile copolymer.
56. The composition of claim 54, wherein the rigid thermoplastic resin is a styrene-acrylonitrile-methyl methacrylate copolymer.
57. The composition of claim 54, wherein the rigid thermoplastic resin separately prepared is present at a level of between about 30 wt. % and about 80 wt. % based on the weight of the entire composition.
58. The composition of claim 33, further comprising an additive selected from the group consisting of colorants, dyes, pigments, lubricants, stabilizers, fillers and mixtures thereof.
59. A rubber modified thermoplastic resin composition comprising about 35 to about 70 wt.% based on the total weight of the resin of an elastomeric phase comprising structural units derived from butyl acrylate, wherein the elastomeric phase is dispersed in a rigid thermoplastic phase, and wherein at least a portion of the rigid thermoplastic phase is grafted to the elastomeric phase, which is prepared by a method comprising the steps of:
 - (a) polymerizing in a first stage in the presence of the elastomeric phase a monomer mixture of styrene and acrylonitrile in a wt./wt. ratio of about 2.6:1, wherein the amount of monomer mixture employed is in a range of between about 15 wt.% and about 85 wt.% based on the total weight of monomer employed in all stages, followed by
 - (b) polymerizing in a second stage in the presence of the elastomeric phase from (a), a mixture of styrene, acrylonitrile and methyl methacrylate, wherein styrene and acrylonitrile are employed in a wt./wt. ratio in a range of between about 1.5:1 and about 4:1, and the wt./wt. ratio of methyl methacrylate to the total of styrene and acrylonitrile is in a range of between about 3:1 and about 1:3.

60. The composition of claim 59, further comprising rigid thermoplastic phase prepared in a separate polymerization step.
61. The composition of claim 60, wherein the rigid thermoplastic resin is a styrene-acrylonitrile copolymer.
62. The composition of claim 60, wherein the rigid thermoplastic resin is a styrene-acrylonitrile-methyl methacrylate copolymer.
63. The composition of claim 60, wherein the rigid thermoplastic resin separately prepared is present at a level of between about 30 wt. % and about 80 wt. % based on the weight of the entire composition.
64. The composition of claim 59, further comprising an additive selected from the group consisting of colorants, dyes, pigments, lubricants, stabilizers, fillers and mixtures thereof.